

Utility Patent Application

of

Robert deRochemont, Jr.

and

Gary Dean Ragner

for

******* Vacuum Nozzle for Hard-Floors *******

CROSS-REFERENCE TO RELATED APPLICATIONS

This utility application claims priority from U.S. **Provisional application Ser. No. 60/427,640**, filed on Nov. 19, 2002, titled "Vacuum Nozzle for Hard-Floors".

BACKGROUND-Field of Invention

The field of this invention relates to vacuum nozzles and more specifically to vacuum nozzles with a valve control mechanism.

BACKGROUND-Description of Prior Art

Vacuum nozzles specifically for hard-floors have been around for years. Most hard-floor nozzles comprise one or more bristle brush strips on the underside of the nozzle. Suction air from a vacuum is directed to the underside of the nozzle to cause a relatively high air-flow rate around the bristle brushes. In this way, dirt dislodged by the bristle brush strips is whisked away by the fast moving air-flow. As many as three horizontal rows of brush strips have been used in nozzle designs. In some designs these brush strips are able to pivot slightly due to loose connections between the nozzle body and the brush strip. The slight amount of pivot aids in cleaning by creating smaller friction force on the floor for the user. The amount of pivot is small since if it over-pivots, the brush will tend to stick strongly on the floor. Such pivoting action is normal for vacuum nozzles for carpeted surfaces, but could be used for hard-floors. The disclosed hard-surface nozzle allows a limited pivoting action of up to plus-or-minus twenty degrees. An angle greater than approximately twenty degrees, from vertical, tends to cause the pivoting cleaning strip to stick and not to flip back and forth as the user pushes the nozzle forward and backward on a hard surface. None of the known prior art shows this pivoting action being used to control airflow around a cleaning strip(s). And none of the prior art shows pivoting cleaning strip(s) that pivot to close-off an air passageway. This valving operation with the cleaning strip(s) is the functional basis of the disclosed invention.

SUMMARY

The disclosed hard-floor nozzle provides superior cleaning with added speed in a low profile design. The hard-floor nozzle is designed to ride very low to the floor, and may have a total overall height of less than one and one-half inches. A pivot joint on the hose wand connector allows the user to lower the hose wand to the floor to get under very low furniture. The nozzle has two major advantages over other hard-floor nozzles. First the open ends on the nozzle allow cleaning at the tips of the nozzle felt strip, such as for cleaning along a wall. Second, the cleaning felt strip, which makes contact with the floor, pivots in its housing to allow the felt strip itself to act as a valve, controlling the flow of suction air to the proper side of the hard-floor nozzle. When gliding forward across a hard surface, the felt strip rotates backward to provide most of the suction air to the front-side of the felt strip. When the hard-floor nozzle is

slid backwards across the surface, the felt strip rotates forward to redirect most of the suction air to the back-side of the felt strip. In this way, the majority of the suction air is diverted to the side of the felt strip facing the direction of motion, to pick-up dirt as the felt strip loosens it.

OBJECTIVES AND ADVANTAGES

Accordingly, several objects and advantages of our invention are:

- a) To provide a low profile hard-floor vacuum nozzle.
- b) To provide a nozzle with edge cleaning ability.
- c) To provide a hard-floor nozzle with a pivotal cleaning strip, where the pivoting of the cleaning strip may divert air to one or the other side of the cleaning strip.
- d) To provide a low-profile vacuum nozzle that may be used on both hard-floors and carpeted floors, and contains a valving means to divert suction air to the proper side of the nozzle's cleaning strip, depending on its direction of motion.

DRAWING FIGURES

Fig. 1 Front view of the disclosed hard-floor cleaning nozzle.

Fig. 2A Section view of cleaning nozzle in **Fig. 1** at section line marked **2A**

Fig. 2B Left side view of cleaning nozzle in **Fig. 1**, pivot connector **40** in section view.

Fig. 3A Section view of cleaning nozzle in **Fig. 1** cut along its center line of symmetry.

Fig. 3B Section view of cleaning nozzle in **Fig. 1** cut along its center line of symmetry

Fig. 4 Side view of alternative cleaning nozzle with round pivot support bar.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In **Figs. 1 through 2B** we see the disclosed invention, comprising a nozzle body **20**, felt strip **30**, and a pivotal hose wand adaptor **40**. Nozzle body **20** and adaptor **40** may be made of plastic or other durable material. Felt strip **30** is made of approximately one-quarter inch thick felt with a pivot support **34** attached along one edge of the felt strip **30**. The bottom edge **31** of the felt strip is designed to make contact with the floor. Pivot support **34** may be made of many different material such as steel, aluminum, injection molded plastic, etc., which can be bonded securely to felt strip **30**, and also provide a pivotal joint when snapped into felt clips **32R** and

32L. Pivot support **34** is shown in **Figs. 1 through 3B** as a “U” shaped steel support channel, which has been crimped over the top edge of felt **30**. Pivot support **34** is designed to pivot within felt clips **32R** and **32L** near the interface between felt **30** and support **34**. Depending on the shape of support **34** different shaped felt clips **32R** and **32L** may be used. In **Fig. 2B** we can see that felt clip **32R** has a heart shaped form to allow support **34** to pivot within it. Pivot point surfaces **33La & 33Lb** on pivot clip **32L** (see **Fig. 2B**), and **33Ra & 33Rb** on pivot clip **32R**, (see **Figs. 3A and 3B**) can expand to accept support **34**, and can be designed to contact support **34** at a higher pivot point to provide a longer pivot arm length for felt **30**. The longer the pivot length for felt **30**, the smaller the angle change needed to provide the approximately 0.200 inches movement between positions **30a** and **30c** from the center position **30b**. In general, when using felt as the cleaning strip material, the maximum angle for position **30a** or **30c** from the vertical should be less than approximately 20 degrees. This angle is determined by the coefficient of friction between the cleaning strip material and the surface being cleaned, so that, sufficient friction in the plane of the floor exists to flip cleaning strip **30** backward to position **30c** and forward to position **30a**, as the nozzle is slid forward and backward, respectfully.

Nozzle body **20** is shaped to provide suction air to the surface being cleaned through air channel **28**, of pivot port **38**, to interior surface cavity **26**, which leads to front-side air channel **26F** and rear-side air channel **26R**. Inverted U-shaped body **24** is connected to air channel **28** and provides a relatively constant-width air channel cavity **26** within it. Cavity **26** directs air over cleaning strip **30**, which is free floating, except at connectors **32R** and **32L**. Additional connectors could be added in between, but a clear air space in air cavity **26b** helps allow suction air to reach ends **35R** and **35L** of the nozzle. Cleaning strip **30** may pivot back and forth as shown by positions **30a** and **30c** to alternately close-off air passages **26F** and **26R**, respectfully.

Fig. 2A shows a cross-section at section line **2A** shown in **Fig. 1**. For clarity, only a slice of the nozzle is taken, so additional portions of the nozzle do not cause confusion. We see in **Fig. 2A** that cleaning strip **30** has open air spaces **26F**, **26b** and **26R** all the way around the center portion of strip **130**. This allows air to flow to ends **35R** and **35L** of the nozzle for cleaning along edges **30R** and **30L** (see **Fig. 1**). Air cavity **26b** increases in height as one nears the center of the nozzle, this is to provide sufficient air space for air suction to reach the ends of the nozzle.

Fig. 2B, shows body **20** in a left side view, and wand adaptor **40** sectioned along its

symmetric axis (centerline of nozzle body **20**). Retaining groove **39** is designed to accept retaining pin **46**, to pivotally lock hose wand adaptor **40** and body **20** together after assembly. The contact between pivot tube surface **38** on nozzle body **20** and cylindrical port surface **48** on wand adaptor **40**, act as a pivot bearing which allows the two parts to pivot along the longitudinal axis of surfaces **38** and **48**. Wand adaptor **40** is designed with an angled section in it between port **44** and port **48**. Port **48** is designed to accept pivot tube **38**. Port **44** is designed to accept a standard sized hose wand (1.25 inches diameter). Thus, a suction passageway is formed which leads from cleaning passages **26F** and **26R** up to cavity **26b**, through channel **28**, through channel **44** and finally into a connected hose wand (not shown), which leads to a vacuum cleaner (not shown).

Figs. 3A and **3B**, show the pivot nozzle body **20** sectioned along its centerline (axis of symmetry). Cleaning strip **30** is also sectioned along the centerline of the nozzle. **Figs. 3A** and **3B** will be discussed more thoroughly in the operation section of this patent.

In **Fig. 4** we see an alternative valved vacuum nozzle which is very similar in design to the nozzle seen in **Figs. 1 through 3B**. Nozzle body **120** is essentially the same as nozzle body **20**. Body **120** comprises a channel body section **124**, a connecting section **122**, and a pivot attachment port **138**. Channel section **124** comprises channel section **124b** in the center of the nozzle and channel sections **124a** and **124c** on the left and right portions respectfully of the nozzle body **120**. Channel sections **124a-c** correspond to channels **126a-c**, respectfully, within them. Bottom edges **124F** and **124R** on channel section **124** are designed to rest slightly above the floor surface **55** during normal operation. Edges **124F** and **124R** can also have cleaning strips added to provide brush and/or squeegee cleaning strips for assisting in removing dirt. Transition section **122** connects port **138** to channel section **124** and also provides an air channel connecting air channel **128** in attachment port **138** to air channel **126b** in channel section **124b**. Retaining grove **139** provides secure attachment of a hose wand connector (not shown) much like groove **39** on body **20** allows pivotal connecting of hose wand connector **40**. The shape of support clips **132R** and **132L** (both aligned in this view so only the tips of **132L** are showing) is slightly different than clips **32R&L** on nozzle body **20**. Clip **132L** is essentially identical to clip **132R** except that it is on the Left-side instead of the Right-side of body **120**. A cylindrically shaped pivot surface **152L** on clip **132L** is shown, which matches up with cylindrically shaped pivot

support bar **134** to provide a bearing structure for pivotal operation of cleaning strip **130**. Pivot clips **132R&L** on nozzle body **124** are positioned similarly to the way pivot clips **32R** and **32L** on nozzle body **24**. Also, end stops **135R** and **135L** (stop **135R** hidden behind stop **135L**), are positioned similarly to end stops **35R** and **35L** on nozzle body **20**. Also, contact surfaces **133La** & **133Lb** on pivot clip **132L**, and corresponding contact surfaces on pivot clip **132R** (contact surfaces on **132R** hidden behind **133La** and **133Lb** in **Fig. 4**), are positioned similarly to contact surfaces **33Ra** & **33Rb** on pivot clip **32R** (see **Figs. 3A** and **3B**) and **33La** & **33Lb** on pivot clip **32L** (see **Fig. 2B**), respectfully, so that cleaning strip **130** can be pivotally attached to body **120**.

Cleaning strip **130** may be a felt strip, brush strip, squeegee strip or other cleaning strip for specific uses. Strip **130** is mounted or bonded to pivot support **134** so they operate as a unit. The cylindrical pivot support **134** interacts pivot surfaces **152R&L** to provide a more stable pivot axis than does pivot support **34** and pivot surfaces **32R-L**, which may rock and slide with respect to each other. Both however, will work sufficiently well for the needed purpose. Opposing clip ends **133La** & **133Lb** (see **Fig. 4**) on clip **132L** and opposing clip ends **133Ra** & **133Rb** (not shown - hidden behind **133La** and **133Lb**, respectfully) on clips **132R**, are designed to spread apart when pivot support **134** is pressed between them, allowing pivot support **134** to snap into place within pivot bearing surfaces **152R** and **152L**. Clips **132R** and **132L** are placed near the ends of body **120** like clips **32R** and **32L** are placed near the ends of body **20** (see **Figs. 1** through **3B**). This provides an airspace within channel body **124b**, which is open above the center portion of cleaning strip **130** and pivot support **134**. This can provide good airflow from the channel body ends **124a** and **124c** (body end **124c** aligned behind body end **124a**). This openness around the central portion of the cleaning strip reduces the chances of dirt and material from getting caught on protrusions and also provides better airflow to the ends **135R** and **135L** (**135R** hidden behind **135L** in **Fig. 4**) of the nozzle body **120**.

OPERATIONAL DESCRIPTION -- Figs. 1, 2A, 2B, 3A, 3B and 4

The operation of the disclosed vacuum cleaner nozzle designs shown in **Figs 1** through **3B** is essentially the same as that for the design in **Fig. 4**. For use, a hose wand (not shown) would be inserted into port **44** and held in place by a friction fit or other holding means. Suction air from the hose wand is conducted through the bend between port **44** and port **48**, down

channel **28**, to cavity **26b** where it is directed to cleaning channels **26F**, **26R**, **26a** and **26c**. Air channels **26F** and **26R** (see **Fig. 2A**) provide suction air along the full width of nozzle body **20** from end cover **35R** to end cover **35L**. As the user cleans a floor, the cleaning strip **30** creates friction against the floor which causes it to pivot within pivot clips **32R&L** in nozzle body **20**. Pivot port **38** is cylindrically shaped so that port **48** can except it and provide pivoting action axially. The user can thus twist a hose wand (not shown) connected to port **44**, to pivot the axis of port **44** so that it is more aligned with a horizontal plane. Pin **46** interacts with groove **39** to allow axial pivoting while retaining port end **38** within port **48**. Cleaning felt strip **30** is designed to pivot between positions **30a** and **30c** (see **Fig. 2B**) depending on the direction of friction force on the felt strip from the cleaning surface. The center position **30b** of felt strip **30** is only a transitional position between stable positions **30a** and **30b**, and only exists for an instant during normal use.

In **Fig. 3A** and **3B**, we see nozzle body **20** sectioned along its center symmetric plane. In **Fig. 3A**, we see body **20** is being pushed forward by the user (hose wand and wand adaptor **40** not shown). Notice that friction has caused felt cleaning strip **30** to pivot backward until it makes contact with rear edge **24R** of inverted u-shaped air channel **24**. Also notice that strip **30** also makes contact with rear portion of end cover **35R** (also with **35L** which is cut away in **Fig. 3A**) to seal off the ends of air channel **26R** (see **Figs. 1, 2A** and **2B**). These contact surfaces allow strip **30** to substantially seal-off suction air from escaping through rear channel **26R**. Thus, most of the suction air is directed to front channel **26F** (see **Fig. 2A**), which is in-front of felt strip **30** for cleaning dirt faster as the nozzle slides forward. The suction airflow would follow airflow path **50a** in this case. After the user slides the nozzle forward a distance they will begin to pull back on the hose wand (not shown) to slide the nozzle toward them (see **Fig. 3B**). When this happens, friction between felt strip **30** and hard surface **55** cause felt strip **30** to rotate toward the front. As the user continues to pull back on the nozzle, felt strip **30** rotates against front edge **24F** and the front portion of end cover **35R** (and **35L**) to seal off front air channel **26F**. Thus, most of the suction-air flows to rear air channel **26R** to pick up dirt moving toward it from the rear (user moving nozzle toward dirt), with the airflow following the air flow path **50b**.

In **Fig. 4**, the operation is essentially the same, with suction air connected at port **138** to nozzle body **120** from a vacuum source through air channel **128**. For nozzle body **120**, the pivot

action is provided by support clips **132R** and **132L** which connect to pivot support bar **134**. The fit between surfaces **152R** and **152L** on clips **132R** and **132L** respectfully and support bar **134**, provide a low friction pivot axis by making the diameter of surfaces **152R&L** slightly larger than surface **134**. When nozzle **120** is pushed forward on surface **55**, friction on cleaning strip **130** causes strip **130** to rotate back into position **130c** (pivot support **134** rotating within pivot clips **132R&L**). In position **130c**, suction air is directed mostly in-front of strip **130**. When nozzle **120** is pulled backward, friction causes cleaning strip **130** to rotate forward to position **130a** (pivot support **134** rotating within pivot clips **132R&L**). In position **130a**, suction air is directed mostly in-back of strip **130**. Thus, as the user cleans, suction air is diverted to the portion of cleaning strip **130** facing the direction of motion, to collect oncoming dirt.

If the cleaning strip (strip **130** and/or pivot support **134**) needs replacement with a new strip or a different style strip, the user can simply snap it out and snap the new one in. In **Fig. 4**, pivot clips **132R&L** are designed to flex outward when pivot support **134** is inserted or removed. For insertion, support **134** is placed in contact with ramp surfaces **133La** and its opposing surface **133Lb** on pivot connector **132L**, and then pushed toward cavity **152L** formed in support **132L**. Support **134** then flexes surfaces **133La & 133Lb** outward and it snaps into place within cavity **152L**. Support **134** is attached the same way on right-side pivot clip **132R**. The removable attachment of the cleaning strip in this way is optional, since a non-recoverable cleaning strip would still provide a working nozzle and felt strips can be expected to last for years during normal use.

In **Fig. 4**, vacuum nozzle **120** can be modified so that the valve action of cleaning strip **130** is assisted by a friction wheel (not shown) or friction wheels. This friction wheel(s) can support a substantial portion of the contact force between vacuum nozzle **120** and surface being cleaned **55**. The remainder of the contact force can be supported by the cleaning strip and/or other support wheels. The friction wheel(s) would connect to pivot support **134** through a friction clutch arrangement. The friction clutch would provide a predetermined torsional friction on support **134** when the friction wheel(s) is rotated. In this way, the friction wheel would be able to continue rolling along surface **55**, and provide a torque to pivot support **134** even when pivot support **134** has pivoted fully in that direction. This torque on support **134** would provide the forces needed to pivot cleaning strip **130** forward and backward to positions **130a** and **130c**,

respectfully. In operation, when the user pushes the modified version of nozzle **120** forward, the friction wheel(s) would rotate counter-clockwise as seen from the perspective of **Fig. 4** because of contact with surface **55**. The friction clutch between the friction wheel and pivot support **134** would create a net torque on support **134**, also in the counter-clockwise direction. This torque would then tend to force cleaning strip **130** to position **130c** so that the majority of suction air is directed in front of (forward of) cleaning strip **130**. When the user pulls the modified version of nozzle **120** backward, the friction wheel(s) would rotate clockwise as seen from the perspective of **Fig. 4** because of contact with surface **55**. The friction clutch between the friction wheel and pivot support **134** would create a net torque on support **134**, also in the clockwise direction. This torque would then tend to force cleaning strip **130** to position **130a** so that the majority of suction air is directed in back of (rearward of) cleaning strip **130**. Thus, the use of friction wheel(s) can allow larger pivot angles for cleaning strip **130**, and still allow the pivot valving action of the cleaning strip.

In **Fig. 4**, nozzle **120** can also be modified to provide linear actuation of pivot support **134**. That is, cleaning strip **130** would be allowed to move forward and backward within air channel **126** (**126a**, **126b**, and **126c**) during operation. Pivot support **124** could be mounted in a slide channel at each end to allow both pivoting and forward and backward sliding of the cleaning strip during use. During operation, the modified cleaning strip could slide forward and backward as well as pivot, so that when the nozzle is pushed forward pivot support **124** slides backward as well as pivoting counter-clockwise as seen in **Fig. 4**. When sliding backward, pivot support **134** and cleaning strip **130** would slide forward in air channel **126** and/or pivot clockwise, depending on the design of the slide channels. Thus, the cleaning strip may slide flat against the side walls of air channels **126**, essentially collapsing the air channel on one side of the cleaning strip. Movement of a modified cleaning strip can also be limited entirely to linear actuation (forward and backward motion only), eliminating the pivot joint completely. This type of design has the potential of allowing very low profile vacuum nozzles, since the cleaning strip can be very short if pivoting is not required. Such a linear cleaning strip could be mounted on a linear slide rail at each end of the nozzle (linear rails may be arched or curved to provide the desired response from friction with surface **55**), so that it can slide forward and backward in the air channel opening between edges **124F** and **124R**. Friction of the linear cleaning strip against

surface **55** can be used to move the linear cleaning strip forward and backward along its linear slide rails. During operation, forward motion of the modified vacuum nozzle with a linear cleaning strip, would create rearward friction on the linear cleaning strip. This rearward force would be used to slide the linear cleaning strip backward and into contact with the rear surface of air channel **126** near bottom edge **124R** (essentially collapsing the air channel rearward of the linear cleaning strip). This action causes the suction air to be substantially directed to the area in front of the linear cleaning strip. When the user moves the modified vacuum nozzle backward, friction forces between surface **55** and the linear cleaning strip causes the linear cleaning strip to slide forward in air channel **126** and seal against forward wall of channel **126** near bottom edge **124F**. This action causes the suction air to be substantially directed to the area behind the linear cleaning strip. Thus, the linear cleaning strip slides to provide suction air to the side of the linear cleaning strip facing the direction of motion of this modified version of vacuum nozzle **120**.

RAMIFICATIONS, and SCOPE

The disclosed hard-floor nozzle provides superior cleaning in a low profile design. A pivot joint on the hose wand connector allow the user to lower the hose wand to the floor to get under very low furniture. A cleaning strip mounted on a pivot joint within the nozzle body to provide both friction cleaning of a surface and to control the suction air flow around the cleaning strip. The pivoting of the cleaning strip within the nozzle body housing allows the strip itself to act as a valve, controlling the flow of suction air to the proper side of the hard-floor nozzle. The open ends on the nozzle allow suction air at the tips of the cleaning strip to cleaning along a wall or edge. When gliding forward across a hard surface, the cleaning strip pivots backward to provide most the suction air to the front-side of the strip. When the hard-floor nozzle is slid backwards across the surface, the cleaning strip rotates forward to provide most of the suction air to the back-side of the strip. In this way, the majority of the suction air is diverted to the side of the cleaning strip facing the direction of motion, to pick-up dirt as the felt strip loosens it.

Although the above description of the invention contains many specifications, these should not be viewed as limiting the scope of the invention. Instead, the above description should be considered illustrations of some of the presently preferred embodiments of this invention. For example, many other modifications could be made to the basic pivot valve operation of the

cleaning strip. The sealing surface between the cleaning strip and the nozzle body can take many shapes while still providing a good seal. Many ways exist to pivotally attach a pivot support to the nozzle body besides the two shown here. Also many different cleaning strips may be used besides the felt strips shown here. The use of felt, bristle brush strips and/or squeegee style strips and combinations of strips are some of the many types of cleaning strips possible. The nozzle can also be made to work well on carpeted floors, since the pivoting action of the cleaning strip allows it to angle backward to help it slide over a carpet. If bristle brush strip were used, the angling of the bristle portion would prevent catching of the bristles on the carpet which normally happens with straight bristle brushes. Also, more than one cleaning strip may be used as long as each cleaning strip has its own inverted u-shaped air channel which the cleaning strip may act like a valve. Alternatively, a multi-cleaning strip nozzle can have some normal cleaning strips while others are the valve operated type described here. Finally, additional cleaning surfaces may be added to end surfaces **24F** and **24R** (see **Fig. 2A**) and also **124R** and **124F** (see **Fig. 4**) to provide extra cleaning function. Such cleaning surfaces may comprise rubber fingers, brush strips, rubber strips, and many others.

Thus, the scope of this invention should not be limited to the above examples, but should be determined from the following claims.